

# Safety Instructions

## **Liquiline CM42**

Supplement to BA00382C

Safety instructions for electrical apparatus for explosion-hazardous areas

FM IS NI Cl.I Div.1&2, Groups A-D

CSA IS NI Cl.I,II,III Div.1&2, Groups A-G



# Liquiline CM42

Supplement to BA00382C

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**Associated documentation** This document is an integral part of Operating Instructions BA00382C.

### Connection requirements for the USA

Note: In addition to the information provided in this control drawing, the FM labelled measurement transmitter CM42 and the cCSAus labelled sensors covered and referenced by this section may be connected and used with transmitters and sensors listed in control drawing no. 139689, based on certificate no. FM16US0145X issued by FM.

### Equipment Ratings valid for the USA

Intrinsically Safe for Class I, Division 1, Groups A, B, C and D; Class I, Zone 1, AEx ib [ia Ga] IIC; Type 4, IP66/67

Non Incendive for Class I, Division 2; Groups A, B, C and D; Class I, Zone 2, Group IIC with Nonincendive field wiring connections to Class I, Division 2, Group A, B, C, and D and Class I, Zone 2, Groups IIC, Type 4; IP66/67

Ambient:  $-20^{\circ}\text{C} < T_a < +50^{\circ}\text{C}(T_6)$

### Devices using 4-20mA / HART outputs

#### Intrinsically safe (Entity), Class I, Div. 1 Groups A, B, C, D Hazardous location installations

1. Control room equipment may not use or generate over 250 Vrms.
2. Use entity-approved intrinsic safety barrier or other associated equipment with  $V_{oc}$  or  $V_f \leq V_{max}$ ,  $I_{sc}$  or  $I_f \leq I_{max}$ ,  $C_a \geq C_i + C_{cable}$ ,  $L_a \geq L_i + L_{cable}$ .

Entity parameters are as follows (current controlled circuits):

Terminals	$V_{max}$	$I_{max}$	$P_{max}$	$C_i$	$L_i$
133 and 134	30 V	100 mA	800 mW	1.2 nF	29 $\mu\text{H}$
233 and 234	30 V	100 mA	800 mW	0.2 nF	24 $\mu\text{H}$

3. Installation should be in accordance with ANSI/ISA RP12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electric Code (ANSI/NFPA70).

#### 4. NOTICE

**Substitution of components may impair intrinsic safety!**

- Observe.

5. Ex ia is defined as Intrinsically Safe.

#### Division 2 and Zone 2 installation (current controlled circuit)

6. The nonincendive field wiring circuit concept allows interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus, using any of the wiring methods permitted for unclassified locations.

Entity parameters are as follows (current controlled circuits):

Terminals	$V_{max}$	$I_{max}$	$C_i$	$L_i$
133 and 134	30 V	<sup>1)</sup>	1.2 nF	29 $\mu\text{H}$
233 and 234	30 V	<sup>1)</sup>	0.2 nF	24 $\mu\text{H}$

- 1) For this current controlled circuit, the parameter ( $I_{max}$ ) is not required and need not be aligned with parameter ( $I_{sc}$  or  $I_f$ ) of the barrier or associated nonincendive field wiring apparatus.

7.  $V_{max} \geq V_{oc}$  or  $V_t$ ,  $C_a \geq C_i + C_{cable}$ ,  $L_a \geq L_i + L_{cable}$

8. Installation shall be in accordance with the NEC.

## 9. NOTICE

Substitution of components may impair suitability for class I division 2 or class I zone 2!

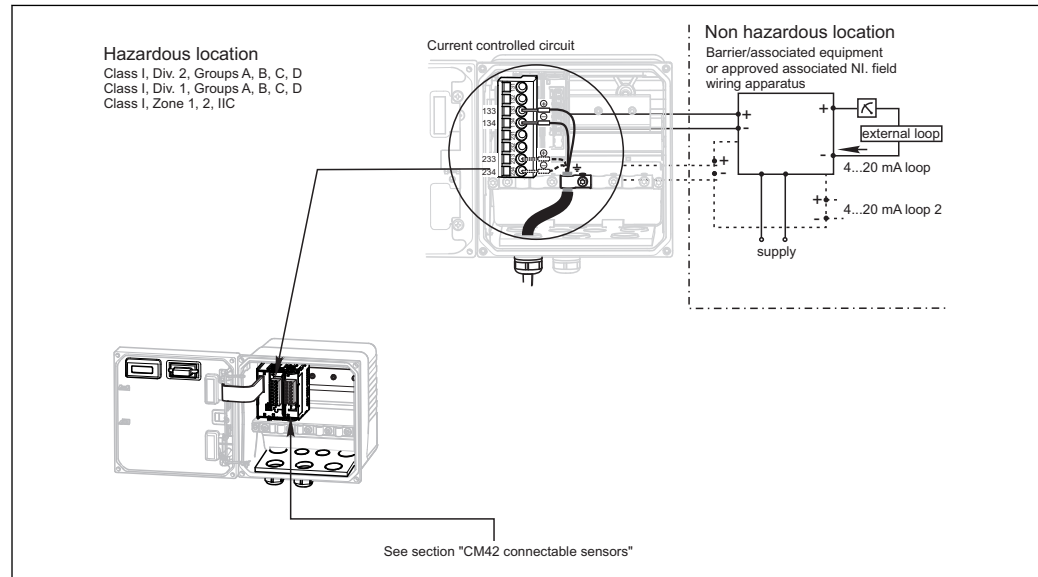
► Observe.

### Functional ratings

These ratings do not supersede hazardous locations values.

Normal current = 3.6 to 22 mA

Normal voltage = 12.5 to 30 V



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### Devices using PROFIBUS and FOUNDATION FIELDBUS outputs

#### FISCO-Concept

The FISCO concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination.

The criteria for interconnection is that the voltage ( $U_i$  or  $V_{max}$ ), the current ( $I_i$  or  $I_{max}$ ) and the power ( $P_i$  or  $P_{max}$ ) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage ( $U_o$  or  $V_{oc}$  or  $V_t$ ), the current ( $I_o$  or  $I_{sc}$  or  $I_t$ ) and the power ( $P_o$  or  $P_{max}$ ) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitances ( $C_i$ ) and inductances ( $L_i$ ) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10  $\mu$ H respectively.

In each segment, only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system.

The voltage ( $U_o$  or  $V_{oc}$  or  $V_t$ ) of the associated apparatus has to be limited to the range of 14 V to 17.5 VDC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50  $\mu$ A for each connected device. Separately powered equipment needs a galvanic isolation to assure the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

loop resistance R':	15 ... 150 $\Omega$ /km
inductance per unit length L':	0.4 ... 1 mH/km
capacitance per unit length C':	80 ... 200 nF/km
C' = C' line/line + 0.5 C' line/screen, if both lines are floating or	
C' = C' line/line + C' line/screen, if the screen is connected to one line	
length of spur cable:	$\leq 30$ m
length of trunk cable:	$\leq 1$ km
length of splice:	$\leq 1$ m

At the end of the trunk cable an approved infallible line termination with the following parameters is suitable:

$$R = 90 \dots 100 \, \Omega$$

$$C = 0 \dots 2.2 \, \mu\text{F}$$

One of the allowed terminations might already be integrated in the associated apparatus. The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, up to a total length of 1000 m (sum of the length of trunk cable and all spur cables), the inductance capacitance of the cable will not impair the intrinsic safety of the installation.

#### NONINCENDIVE CLASS 1, DIV.2, GROUP A.B.C.D HAZARDOUS LOCATION INSTALLATION

1. Install per national electric code (NEC) using threaded metal conduit. Intrinsic safety barrier not required. Max. supply voltage 30 V. For T-code see table.

#### 2. **⚠ WARNING**

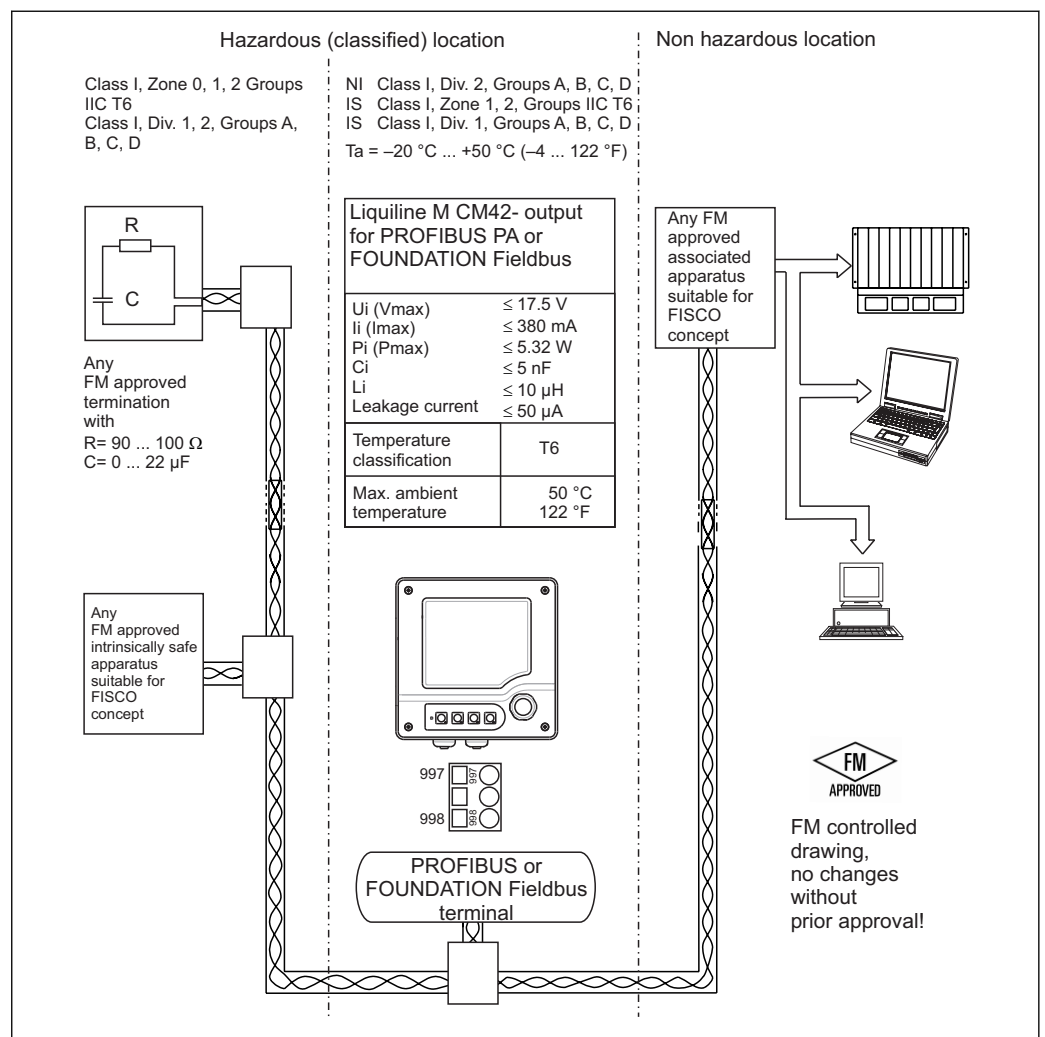
##### Explosion Hazard!

- Do not disconnect equipment unless power has been switched off or the area is known to be Non Hazardous.

#### **NOTICE**

**Substitution of components may impair suitability for CLASS I, Division 2!**

- Observe.



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For sensor connection: → 11

**Connection requirements for Canada**

Note: In addition to the information provided in this control drawing, the CSA labelled measurement transmitter CM42 and the cCSAus labelled sensors covered and referenced by this section may be connected and used with transmitters and sensors listed in control drawing no. 139711, based on certificate no. 1718339 issued by CSA.

**Equipment Ratings valid for Canada**

Class I, Division 1, Groups A, B, C, D; Class II, Groups E, F, G, Class III, Type 4; IP66/67

Class I, Division 2, Groups A, B, C and D, Type 4; IP66/67

Ambient:  $-20\text{ }^{\circ}\text{C} < T_a < +50\text{ }^{\circ}\text{C} (T6)$   
 $-20\text{ }^{\circ}\text{C} < T_a < +55\text{ }^{\circ}\text{C} (T4)$

**Devices using 4-20mA / HART outputs**

Transmitter Intrinsically Safe and Non-incendive Entity Parameters:

Terminals	$V_{\max}$	$I_{\max}$	$C_i$	$L_i$
133 and 134	30 V	100 mA	1.2 nF	29 $\mu\text{H}$
233 and 234	30 V	100 mA	0.2 nF	24 $\mu\text{H}$

**Notes for CL. I, II and III Intrinsically Safe Installation:**

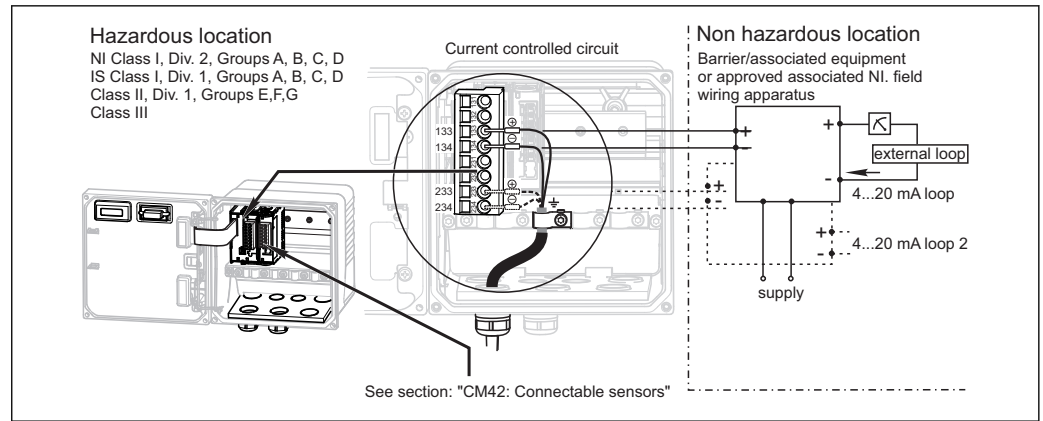
1. Install per the Canadian Electrical Code, Part I.
2. Control room equipment connected in the non-hazardous location must not use or generate voltages greater than 250 Vrms.
3. 4-20 mA circuit(s) must be connected to Certified Associated Equipment where the following conditions are met for each loop:  $V_{oc} \leq V_{\max}$ ,  $I_{sc} \leq I_{\max}$ ,  $C_a \geq C_i + C_{\text{cable}}$ ,  $L_a \geq L_i + L_{\text{cable}}$ .
4. Each 4-20 mA circuit must use twisted, shielded pairs. Cable insulation and shielding must be maintained to within 10 mm from terminal block connection.
5. Sensor wiring is intrinsically safe for connection to the specified sensors.

**Notes for CL. I, Div.2 Non-incendive Field Wiring Installation:**

1. Install per the Canadian Electrical Code, Part I.
2. Control room equipment connected in the non-hazardous location must not use or generate voltages greater than 250 Vrms.
3. 4-20mA circuit(s) must be connected to Certified Associated Equipment (I.S. barriers) or Certified equipment that provides non-incendive field wiring circuits where the following conditions are met for each loop:  $V_{oc} \leq V_{\max}$ ,  $I_{sc} \leq I_{\max}$ ,  $C_a \geq C_i + C_{\text{cable}}$ ,  $L_a \geq L_i + L_{\text{cable}}$  (The 4-20 mA loops are current controlled circuits and therefore the Isc parameter and Imax parameter need not be aligned.).
4. Each 4-20 mA circuit must use twisted, shielded pairs. Cable insulation and shielding must be maintained to within 10mm from terminal block connection.
5. Sensor wiring is non-incendive field wiring for connection to the specified sensors.

**Notes for CL. I, Div. 2 Installation:**

1. Install per the Canadian Electrical Code, Part I.
2. 4-20 mA circuits must be installed using CL. I, Div. 2 wiring methods.
3. Only cable entry thread NPT 1/2" is applicable.
4. Sensor wiring is non-incendive field wiring for connection to the specified sensors.



### Devices using PROFIBUS and FOUNDATION FIELDBUS outputs

#### PROFIBUS PA and FOUNDATION Fieldbus Installation in Class I, Div 1, GROUP A, B, C, D

##### Hazardous Locations

##### FISCO-Concept

The FISCO concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination.

The criteria for interconnection is that the voltage ( $U_i$  or  $V_{max}$ ), the current ( $I_i$  or  $I_{max}$ ) and the power ( $P_i$  or  $P_{max}$ ) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage ( $U_o$  or  $V_{oc}$  or  $V_t$ ), the current ( $I_o$  or  $I_{sc}$  or  $I_t$ ) and the power ( $P_o$  or  $P_{max}$ ) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitances ( $C_i$ ) and inductances ( $L_i$ ) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10  $\mu$ H respectively.

In each segment, only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system.

The voltage ( $U_o$  or  $V_{oc}$ ) of the associated apparatus has to be limited to the range of 14 V to 24 V DC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50  $\mu$ A for each connected device. Separately powered equipment needs a galvanic isolation to assure the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

loop resistance $R'$ :	15 ... 150 $\Omega$ /km
inductance per unit length $L'$ :	0.4 ... 1 mH/km
capacitance per unit length $C'$ :	80 ... 200 nF/km
$C' = C' \text{ line/line} + 0.5C' \text{ line/screen}$ , if both lines are floating or	
$C' = C' \text{ line/line} + C' \text{ line/screen}$ , if the screen is connected to one line	
length of spur cable:	$\leq 30$ m
length of trunk cable:	$\leq 1$ km
length of splice:	$\leq 1$ m

At the end of the trunk cable an approved infallible line termination with the following parameters is suitable:

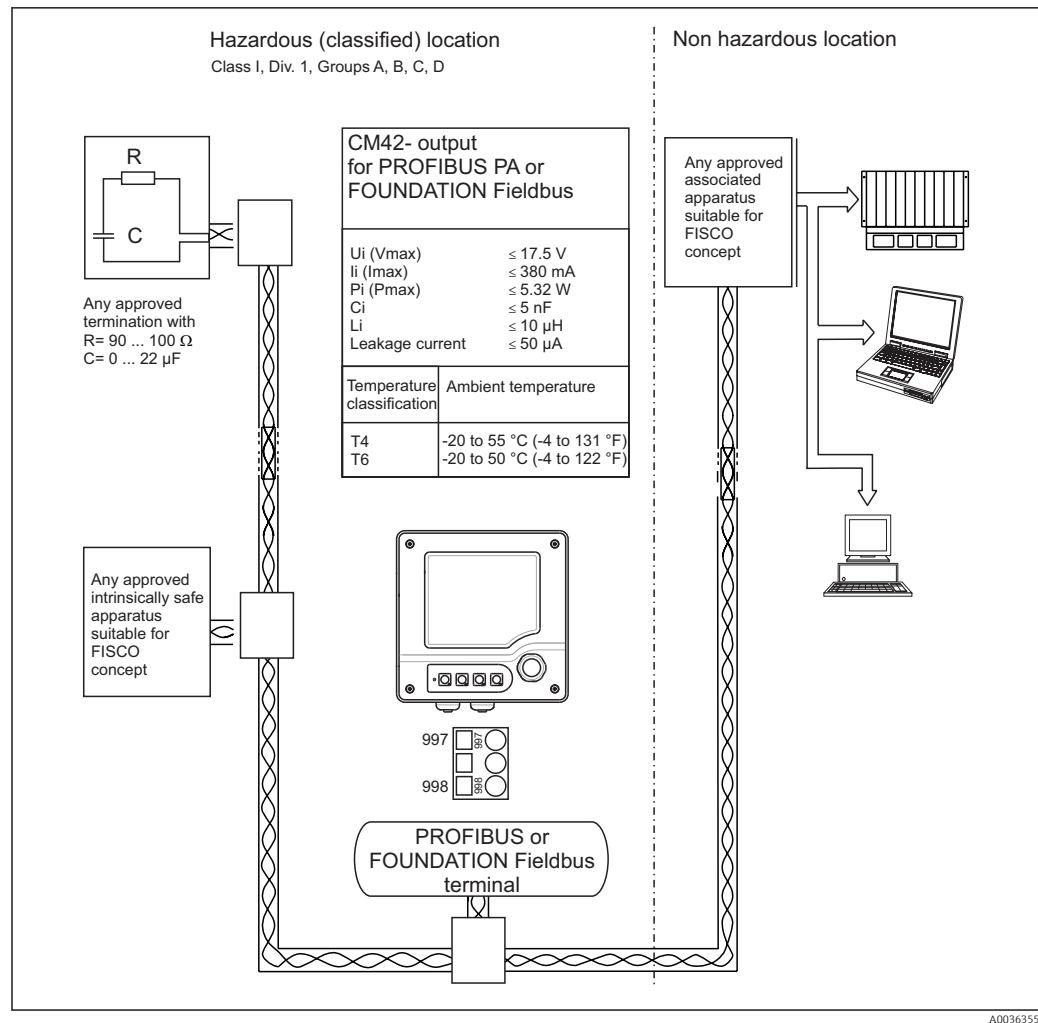
$$R = 90 \dots 100 \, \Omega$$

$$C = 0 \dots 2.2 \, \mu\text{F}$$

One of the allowed terminations might already be integrated in the associated apparatus.

One of the allowed terminations might already be integrated in the associated apparatus. The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, up to a total length of 1000 m (sum of the length of trunk cable and all spur cables), the inductance capacitance of the cable will not impair the intrinsic safety of the installation.

- Install per the Canadian Electrical Code, Part I for intrinsically safe field wiring.



For sensor connection: → 11

### PROFIBUS PA and FOUNDATION FIELDBUS INSTALLATION IN CLASS I, DIV 2, GROUP A, B, C, D HAZARDOUS LOCATIONS

The FNICO concept allows interconnection of non-incendive apparatus to associated apparatus not specifically examined in such combination.

The criteria for interconnection is that the voltage ( $U_i$  or  $V_{max}$ ), the current ( $I_i$  or  $I_{max}$ ) and the power ( $P_i$  or  $P_{max}$ ) which non-incendive apparatus can receive and remain non-incendive, considering faults, must be equal or greater than the voltage ( $U_o$  or  $V_{oc}$ ), the current ( $I_o$  or  $I_{sc}$ ) and the power ( $P_o$  or  $P_{max}$ ) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitances ( $C_i$ ) and inductances ( $L_i$ ) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 20 μH respectively.

In each segment, only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system.

The voltage ( $U_o$  or  $V_{oc}$ ) of the associated apparatus has to be limited to the range of 14 V to 24 V DC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 μA for each connected device. Separately powered equipment needs a galvanic isolation to assure the non-incendive fieldbus circuit remains passive.



The cable used to interconnect the devices needs to have the parameters in the following range:

loop resistance R':	15 ... 150 $\Omega$ /km
inductance per unit length L':	0.4 ... 1 mH/km
capacitance per unit length C':	80 ... 200 nF/km
C' = C' line/line + 0.5C' line/screen, if both lines are floating or	
C' = C' line/line + C' line/screen, if the screen is connected to one line	
length of spur cable:	$\leq 30$ m
length of trunk cable:	$\leq 1$ km
length of splice:	$\leq 1$ m

At the end of the trunk cable an approved infallible line termination with the following parameters is suitable:

$$R = 90 \dots 100 \Omega$$


$$C = 0 \dots 2.2 \mu\text{F}$$

One of the allowed terminations might already be integrated in the associated apparatus.

One of the allowed terminations might already be integrated in the associated apparatus. The number of passive devices connected to the bus segment is not limited due to N.I. reasons. If the above rules are respected, up to a total length of 1000 m (sum of the length of trunk cable and all spur cables), the inductance capacitance of the cable will not impair the non-incendive installation.

- Install per the Canadian Electrical Code, Part I for non-incendive field wiring.

#### CLASS I, DIV 2, GROUP A, B, C, D HAZARDOUS LOCATION INSTALLATION.

1. Install per the Canadian Electrical Code, Part I.
2. Bus wiring must be installed using CLASS I, DIV 2 wiring methods.
3. Only cable entry thread NPT ½" is applicable.
4. Associated apparatus suitable for FNICO is not required. Max. supply voltage 32 V.
5.  **WARNING**

#### Explosion Hazard!

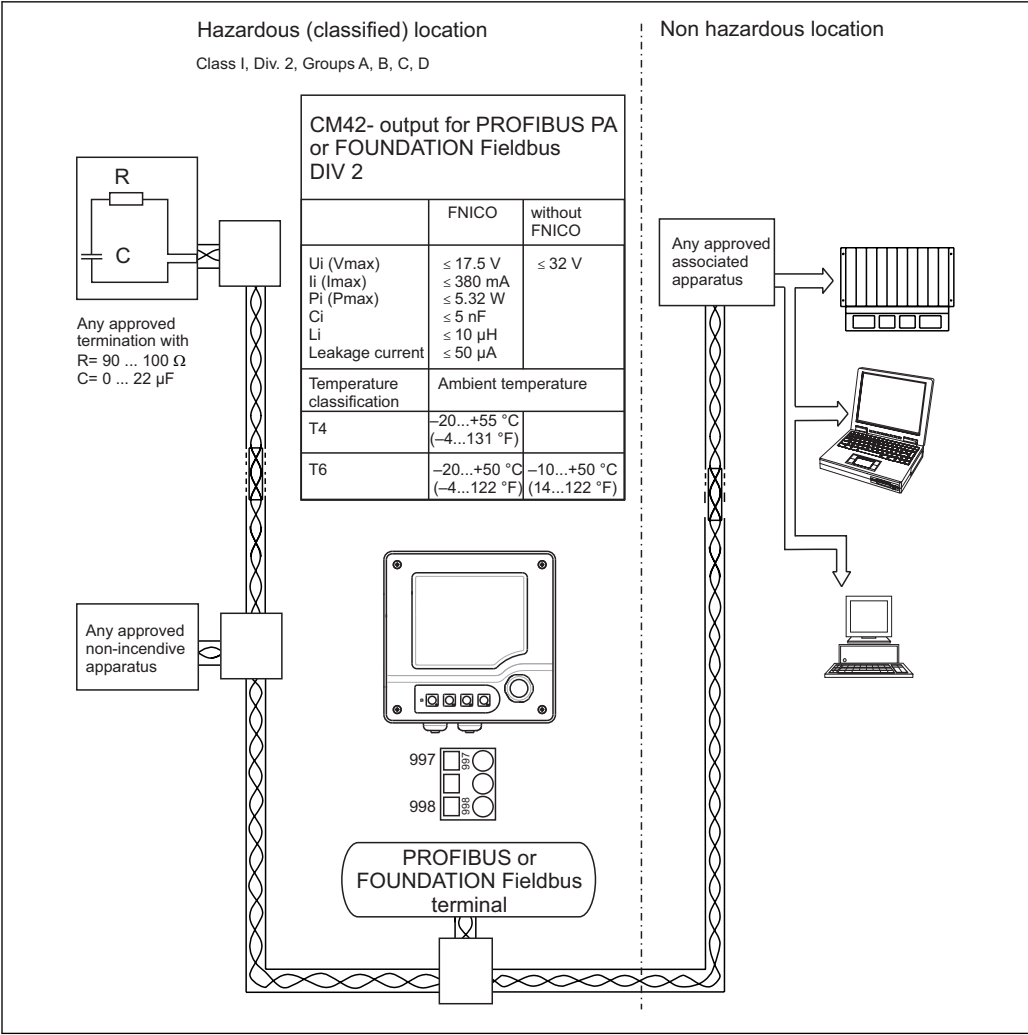
- Do not disconnect equipment unless power has been switched off or the area is known to be Non Hazardous.

#### NOTICE

#### Substitution of components may impair suitability for CLASS I, Division 2!

- Observe.

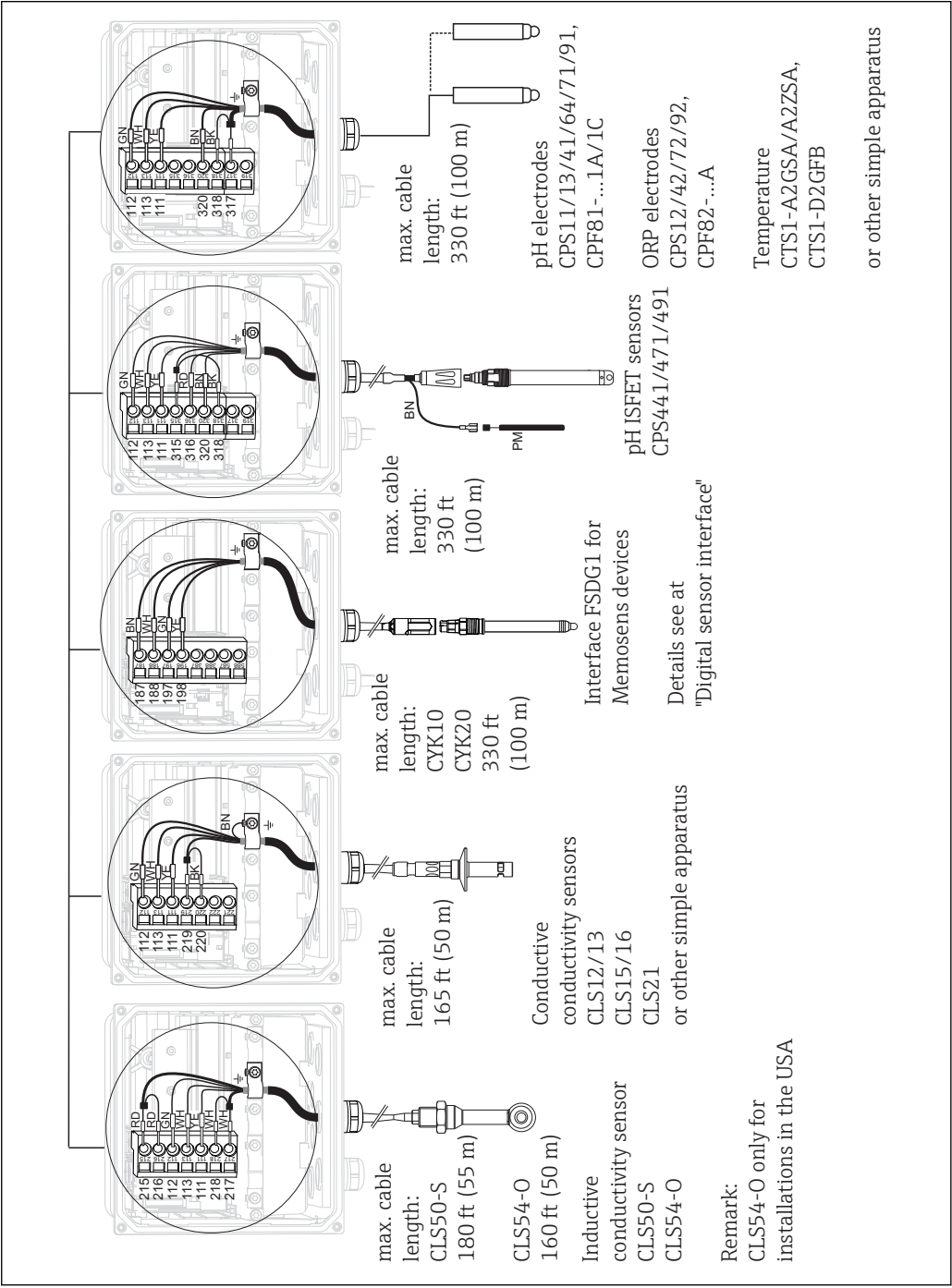
Sensor wiring is non-incendive field wiring for connection to specified sensors (→  11).



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CM42 Connectable sensors

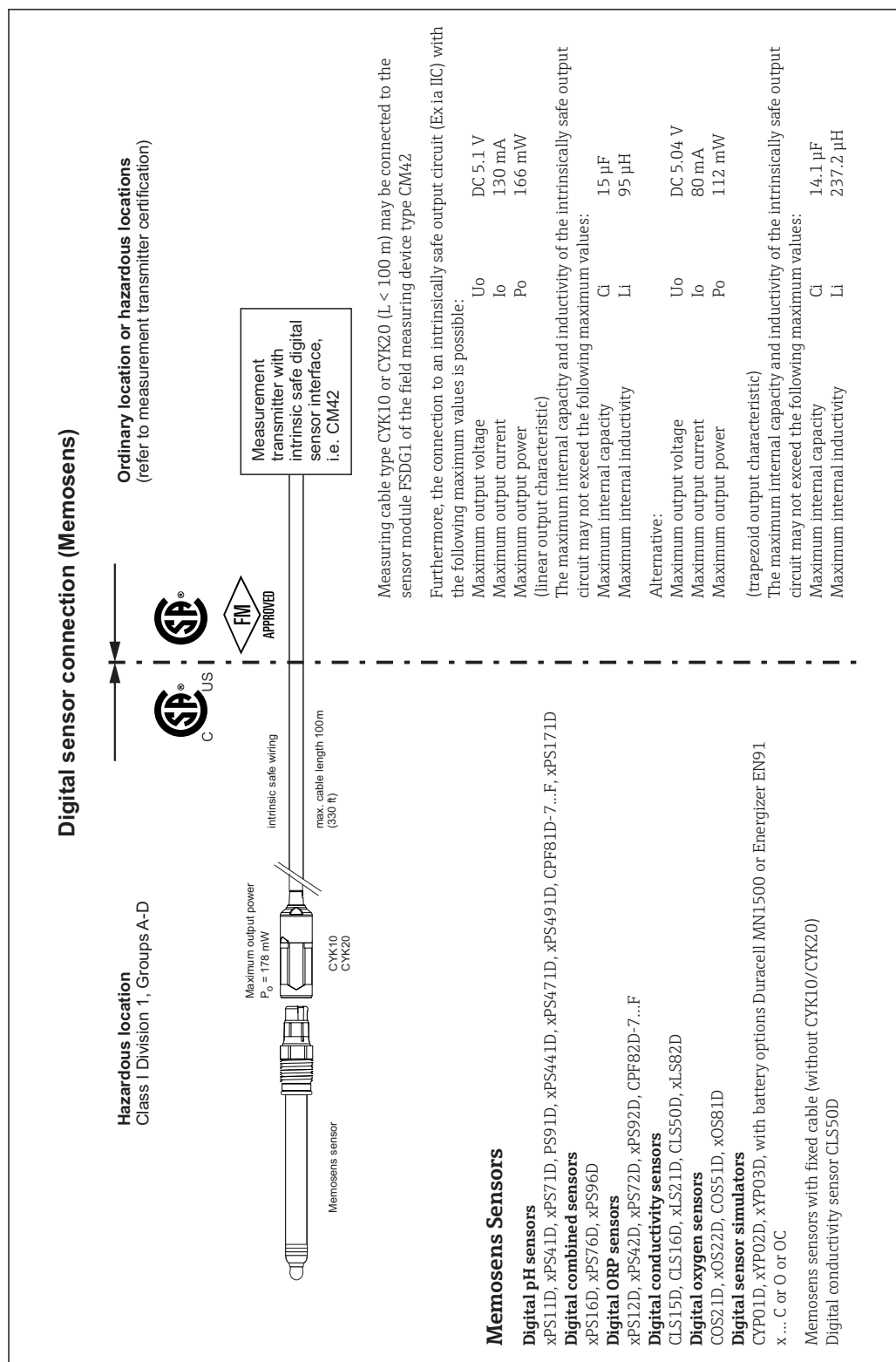
For devices using 4-20mA / HART, PROFIBUS and FOUNDATION FIELDBUS outputs.



A0043740

Digital sensor interface

Terminals	187-188, 197-198
Maximum output voltage $U_o$	5.04 V
Maximum output current $I_o$	80 mA
Maximum output power $P_o$	112 mW
Effective internal capacitance $C_i$	12.4 $\mu$ F (only internally, not effective)
Effective internal inductance $L_i$	160.4 $\mu$ H (only internally, not effective)



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